NOTES ON A PYCNIDIAL FUNGUS ASSOCIATED WITH A DYING-BACK OF APPLE BRANCHES

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NOTES ON A PYCNIDIAL FUNGUS ASSOCIATED WITH A DYING-BACK OF APPLE BRANCHES.

(With 7 Text-figs.)

By E. A. Southee and F. T. Brooks.

Field Observations.

A few years ago some Lord Derby apple trees at Meldreth, Cambridgeshire, were brought to our notice, large and smal branches of which were gradually dying back. In the early stages of disease the bark was affected in long strips on one side

of the branch, with sometimes a sharp line of demarcation between the healthy and diseased tissues so that something in the nature of a canker was produced (cf. Fig. 1).

Occasionally, death of the bark in a long branch appeared to begin at the place of attachment of a spur which had been killed, but, more frequently, it could not be ascertained where

Fig. 1. Photograph of diseased bark on a Lord Derby apple tree. Natural size.

the disease had commenced. The disease frequently spread round the whole of the bark, and branches so affected died back. A characteristic feature of the dead bark was the manner in which the superficial tissues peeled away from the underlying parts.

A few trees of other varieties of apples such as Lane's Prince Albert and Cox's Orange Pippin have been seen to be affected by the same disease in other parts of the country, but the disease is uncommon.

The Fungus Associated with the Disease.

On dead parts of branches from which the superficial tissues had peeled away fructifications of a fungus were invariably found. These were small, more or less spherical bodies, greyish

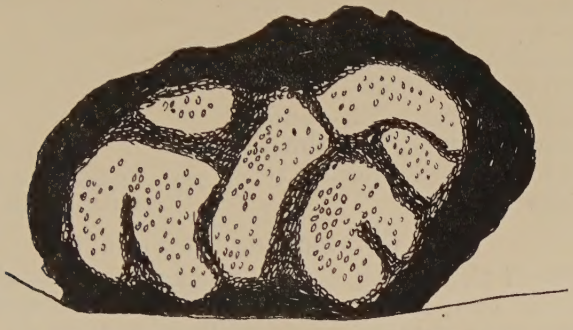

Fig. 2. Long. section through a naturally occurring stroma. × 100.

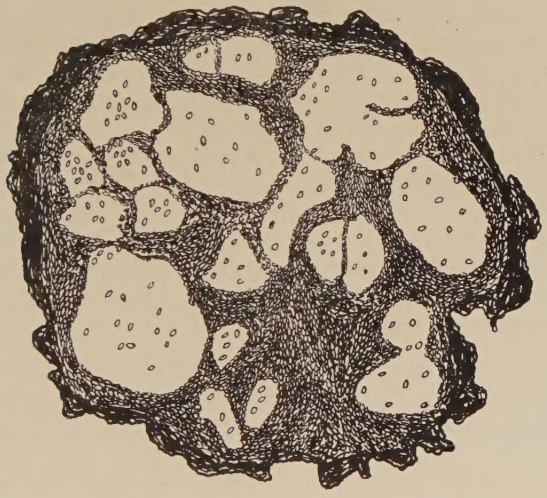

Fig. 3. Trans. section through a naturally occurring stroma. × 100.

black in colour, and about 1 mm. in diameter. These fructifications are stromata in which are embedded one or several pycnidia, more than one chamber being occasionally connected with a single ostiole (cf. Figs. 2 and 3).

The spores are formed from the extremities of short, tapering conidiophores, which line the base of the pycnidium. The spores

are oval or sub-globose in shape with rounded ends, have a large, conspicuous guttule, and are mostly hyaline, although a few (less than 1 per cent.) become light brown with age (cf. Fig. 4).

The spores vary in size from 9–14 × 7–10μ, averaging 10 × 7·5μ. The spores exude from the ostioles as creamy masses.

Although the fungus is confined to the bark at first, it ultimately penetrates the wood, causing it to become discoloured.

Fig. 4. Spores from a naturally occurring stroma. × 800.

Pure Cultures of the Fungus.

Cultures of the fungus were established from single spores upon potato agar, apple wood-extract agar, and apple twigs. The fungus grew well and produced fructifications on all these media. On sterilised apple twigs, however, the stromata bearing the pycnidia were often considerably elongated and projected from the surface as horn-like processes. Upon examining the pycnidia formed in culture it was seen that although some contained only the type of spore found in nature, others contained also large numbers of hyaline, straight, rod-like spores, 3–4 × 1μ in size. These rod-like spores were never encountered in naturally-occurring pycnidia. As the cultures were continued, some pycnidia produced only the rod-like type of spore. The large pycnospores formed in culture frequently contained several guttules instead of the one characteristic of those found in nature.

Cultures of the fungus obtained from the junction of diseased and healthy tissues behaved in the same manner as those arising from single spores.

Germination of the Spores.

Spore germination was studied in hanging drop cultures of apple wood-extract and in thin films of apple wood-extract

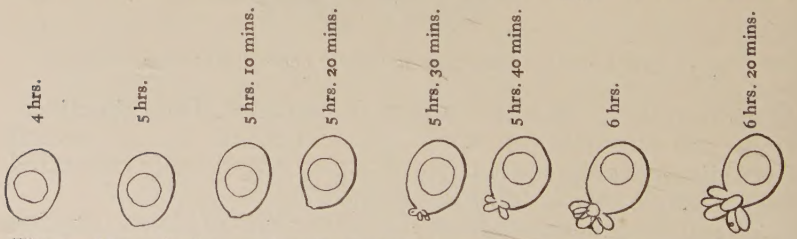

Fig. 5. Stages in the usual method of spore germination, the intervals after the time of placing the spores in the culture medium being indicated. × 1400.

agar spread on glass slides. The mode of germination was of two principal kinds, the commonest being of a peculiar nature.

After a few hours in the culture medium the spore swells and begins to show a slight prominence at one end. Shortly afterwards, bud-like protuberances arise in association with this prominence; these ultimately form secondary spores which break away from the mother spore. They are hyaline and measure 4·5–8·5 × 2–5·5 μ (cf. Fig. 5).

After another twenty hours these "budded," secondary spores

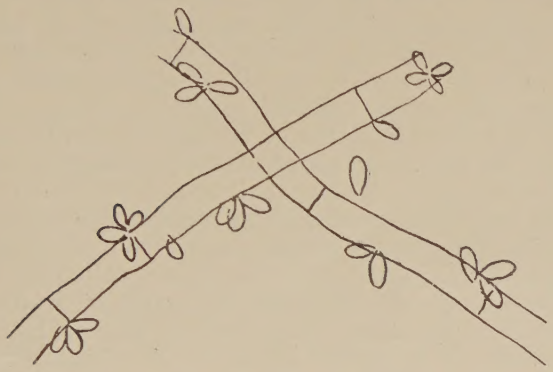

Fig. 6. Spores borne directly on the mycelium formed after germination. × 1400.

germinate from one or both ends to form hyphae. Meanwhile from the opposite end of the mother spore a normal germ tube usually arises, which develops into a mycelium. The mycelium, whether derived direct from a pycnospore or a "budded" spore, in turn forms other spores laterally, arranged singly or in groups, similar in size to the "budded" spores (cf. Fig. 6).

In the other type of germination, which is exceptional, two or three germ tubes of the usual kind arise from the pycnospores (cf. Fig. 7).

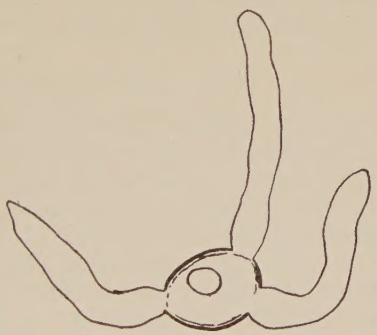

Fig. 7. Another, but exceptional, type of spore germination (after 24 hours). × 1400.

There are modifications in detail between these two types of germination.

We did not succeed in germinating the small, rod-like spores

Systematic Position of the Fungus.

There is considerable uncertainty about the systematic position of this pycnidial fungus. It probably belongs to the Sphaerioidaceae-Hyalosporae section of the Sphaeropsidales, although a few of the spores are brownish in colour. The choice of genus would appear to lie between *Dothiopsis*, *Cytosporella*, and *Dothiorella*. The naturally-occurring fructifications contain either one or several pycnidia, so that in this respect the distinction between *Dothiopsis* and *Cytosporella* breaks down. The distinction between *Cytosporella* and *Dothiorella* is based upon the size and shape of the spores, a not very satisfactory criterion.

As far as we are aware the small rod-shaped spores produced in some pycnidia under cultural conditions have not been described as occurring in either of the genera mentioned above, but as they do not occur under natural conditions, little stress need be laid on them. These small spores are similar in many respects to the "B" spores of many species of *Phomopsis*.

We are inclined to refer the fungus to the genus *Cytosporella*, especially as Mr J. Ramsbottom has kindly called our attention to a species *Cytosporella fructorum*, occurring on fruits of *Pyrus* in Belgium, which has been described by Él. and Ém. Marchal in the *Bulletin de la Société Royale de Botanique de Belgique*, LIV (1921), 125, and which agrees closely with the fungus now under consideration. Our fungus diverges slightly from that described by É. and É. Marchal in that the spores are not exactly globose and are slightly larger. It seems best, however, provisionally to assign the fungus to this species. An effort was made to obtain material of *Cytosporella fructorum* from Monsieur Marchal, but unfortunately it was not available.

Inoculation Experiments.

A large number of inoculation experiments with pure cultures of the fungus were carried out in wounds made in branches of Lord Derby apple trees, but in no case did infection result. It was invariably found that the fungus, after penetrating the tissues slightly, soon ceased to develop further, and the wound was ultimately occluded. The pathogenicity of this fungus is therefore still in doubt. Observations in the field indicated that the fungus was behaving as a slow-growing parasite, and it may be that it can only act parasitically in trees which have been weakened by some other cause. Recent work in the pathology of fruit trees indicates that there are several fungi which act destructively only when the trees are in a debilitated condition. The Lord Derby apple trees on which the fungus

chiefly occurred were growing amongst rank grass in a rather poorly drained, heavy soil overlying chalk. Such conditions may have led to considerable weakening of the trees, allowing the fungus to attack them.

Summary.

1. A die-back of the branches of Lord Derby apple trees in Cambridgeshire is described.

2. A pycnidial fungus is constantly associated with this disease. There is some uncertainty about the identity of the fungus, but it is provisionally named *Cytosporella fructorum*, a species which Él. and Ém. Marchal have described as occurring on fruits of *Pyrus* in Belgium.

3. The methods of germination of the pycnospores are described. The commonest mode of germination is peculiar in that secondary spores are budded off from one end of the pycnospore.

4. Under cultural conditions many pycnidia give rise to small rod-like spores which have not been found in nature.

5. Inoculation experiments with the fungus were unsuccessful in reproducing the disease. It is likely that the fungus behaves as a parasite only when the trees are already weakened from some other cause.